

PRELIMINARY DATA SUMMARY

April 1987

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

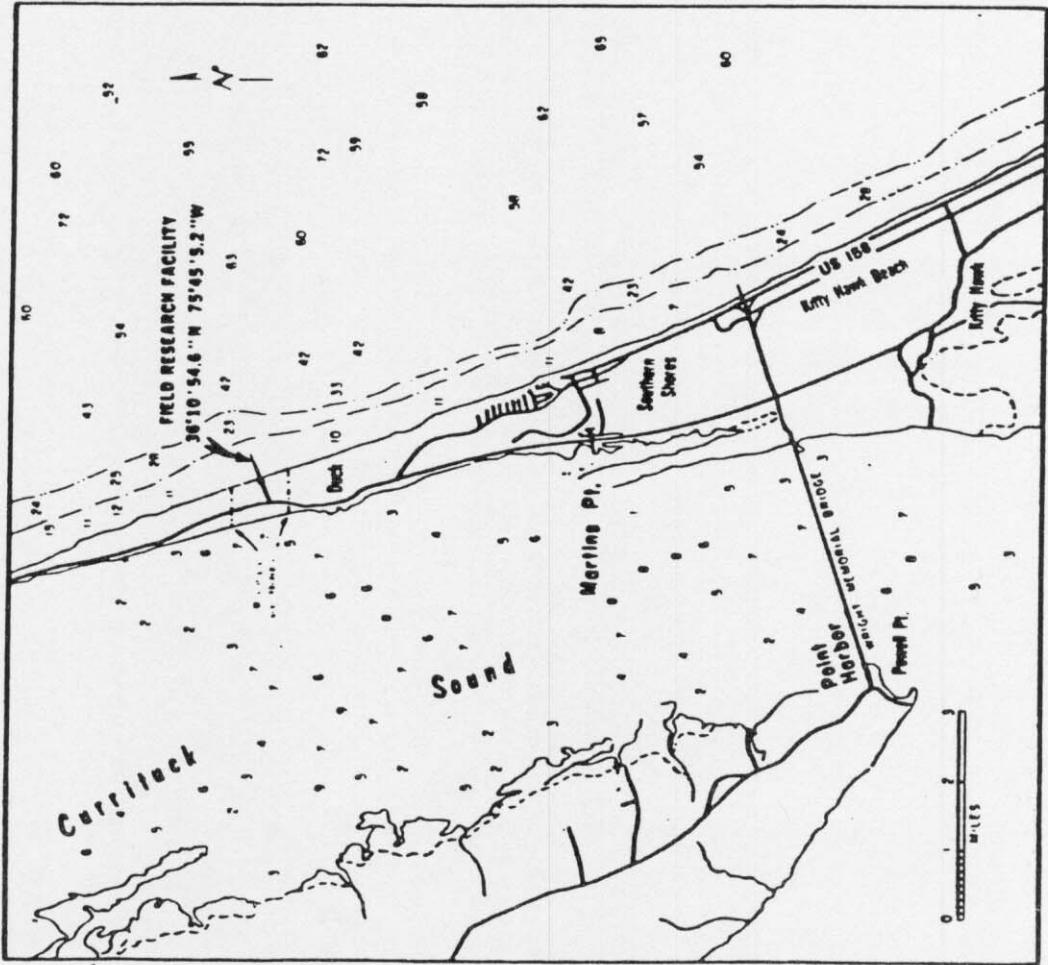
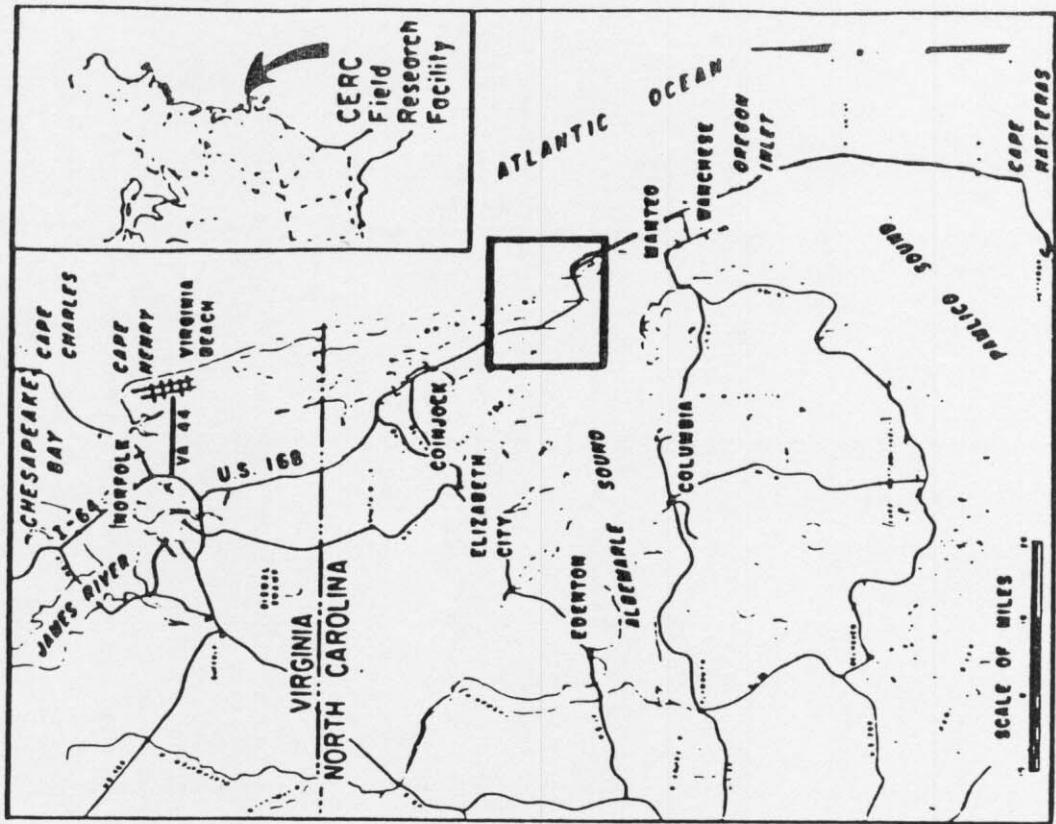


Figure 1. FRF Location Map

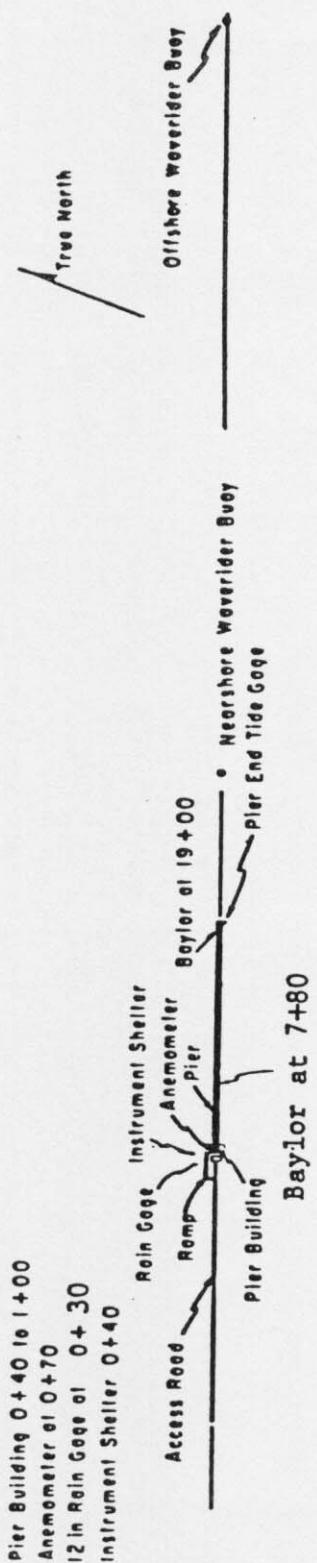
TABLE 1
INSTRUMENT STATUS/DATA AVAILABILITY

April 1987

GAGE NUMBER	DESCRIPTION/REMARKS	DEPTH AT SENSOR	DAY OF THE MONTH									
			1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30									
	Barometric Pressure		Instrument Status									
		Data Collected	■	■	■	■	■	■	■	■	■	■
		Analog Record	■	■	■	■	■	■	■	■	■	■
	Precipitation	Instrument Status	■	■	■	■	■	■	■	■	■	■
		Data Collected	■	■	■	■	■	■	■	■	■	■
		Analog Record	■	■	■	■	■	■	■	■	■	■
	Air Temperature	Instrument Status	■	■	■	■	■	■	■	■	■	■
	Anemometer on Lab Bldg - Elevation 19m (MSL)	Data Collected	■	■	■	■	■	■	■	■	■	■
		Analog Record	■	■	■	■	■	■	■	■	■	■
	Baylor staff located at sta- tion 7+80 on FRF pier	Instrument Status	■	■	■	■	■	■	■	■	■	■
645	See profile	Data Collected	■	■	■	■	■	■	■	■	■	■
625	Baylor staff located at station 19+00 on FRF pier	Instrument Status	■	■	■	■	■	■	■	■	■	■
		Data Collected	■	■	■	■	■	■	■	■	■	■
640	Waverider buoy located 1.0 km from shore	Approx. 8.5 m MSL	Instrument Status	■	■	■	■	■	■	■	■	■
630	Waverider buoy located 6.0km from shore	Approx. 18 m. MSL	Instrument Status	■	■	■	■	■	■	■	■	■
679	Current meter 500m south (0.5km offshore)	Approx. 6 m MSL	Instrument Status	■	■	■	■	■	■	■	■	■
865-1370	NOAA primary tide station located at seaward end of FRF pier	Instrument Status	■	■	■	■	■	■	■	■	■	■
		Data Collected	■	■	■	■	■	■	■	■	■	■

Instrument Status: Operational ■ - Daily Observation: YES
 Analog Record: ALL , PARTIAL
 Data Collected: ALL , SOME

Analog Record: ALL , SOME
 Preliminary Analysis: ALL , SOME



Current meter 500m south of pier

CURRITUCK SOUND

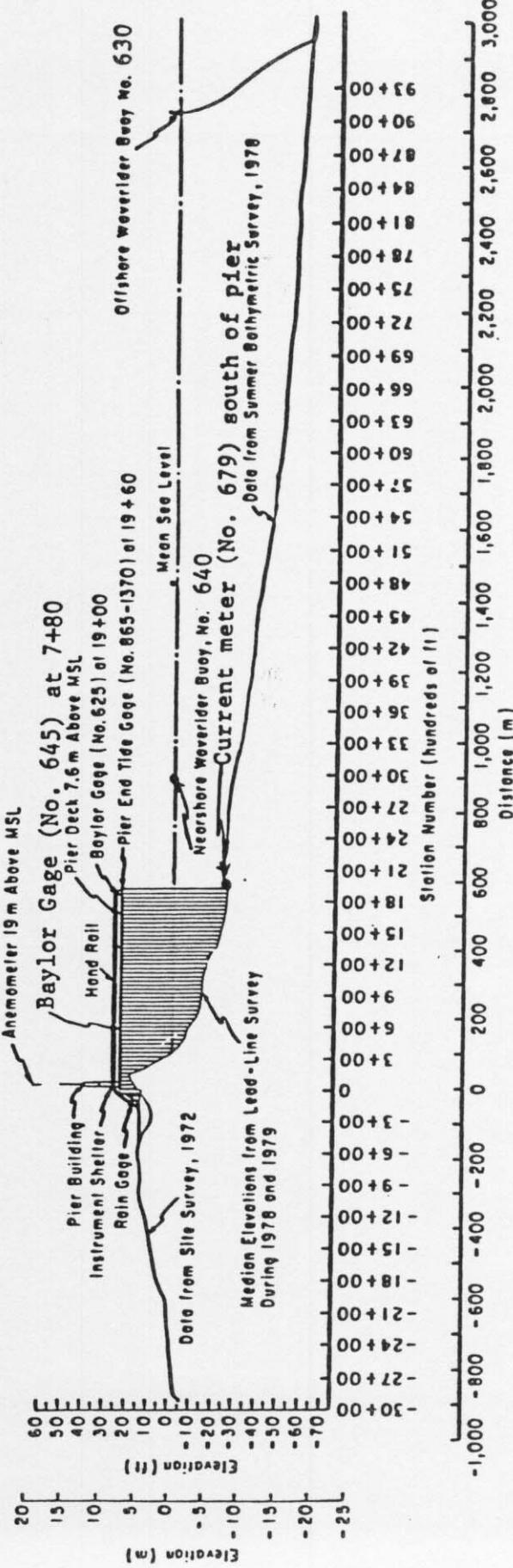


Figure 2. Instrument locations at FRF.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $mm \times .03937 = in$
2. Millibars (mb) to inches of mercury (in Hg) -
 $mb \times 0.02953 = in Hg$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

TABLE 2: Meteorological Data

APR 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
1	100	10	359	5.1	1013.6	0
	700	8	348	2.8	1019.0	0
	1300	5	34	5.0	1018.7	0
	1900	4	154	4.2	1018.3	0
2	100	4	199	7.4	1019.0	0
	700	4	204	9.3	1019.7	0
	1300	7	187	15.5	1016.6	0
	1900	8	204	13.0	1015.6	0
3	100	4	221	11.7	1018.0	0
	700	3	33	7.7	1018.0	0
	1300	4	21	8.6	1015.6	0
	1900	4	122	10.2	1010.9	7
4	100	5	146	9.1	1004.1	5
	700	10	224	10.7	1002.1	0
	1300	10	227	8.5	1005.1	0
	1900	8	235	9.0	1007.5	0
5	100	7	237	6.3	1008.9	0
	700	5	237	5.6	1009.5	0
	1300	4	249	8.0	1009.9	0
	1900	3	241	7.5	1010.2	0
6	100	3	271	6.3	1009.2	0
	700	5	274	5.9	1007.8	0
	1300	8	262	7.1	1007.8	0
	1900	4	295	8.1	1008.9	0
7	100	4	225	8.6	1008.5	0
	700	5	259	9.1	1007.8	0
	1300	6	244	14.6	1006.8	0
	1900	3	250	14.1	1006.1	0
8	100	2	348	11.4	1006.1	0
	700	4	308	11.4	1007.8	0
	1300	2	277	16.3	1007.8	0
	1900	4	191	13.8	1007.2	0
9	100	4	211	12.4	1006.5	0
	700	4	343	11.8	1008.2	0
	1300	10	27	10.8	1009.2	0
	1900	3	45	9.6	1010.9	0
10	100	4	229	10.2	1012.2	0
	700	5	252	12.6	1012.6	0
	1300	5	233	18.5	1011.6	0
	1900	4	224	14.2	1010.9	0
11	100	4	205	13.7	1011.9	0
	700	3	196	15.9	1013.3	0
	1300	7	180	22.2	1012.2	0
	1900	5	142	11.9	1011.2	0
12	100	4	185	16.6	1012.2	0
	700	4	218	16.0	1012.9	0
	1300	5	196	24.8	1011.2	0
	1900	0		17.3	1009.2	0
13	100	0		15.1	1012.6	12
	700	0		14.7	1015.3	0
	1300	3	103	15.5	1016.6	0
	1900	7	39	12.2	1021.0	0
14	100	8	45	9.0	1024.8	0
	700	9	47	8.9	1024.8	0
	1300	5	43	10.5	1025.8	66
	1900	6	63	9.9	1023.4	0
15	100	4	68	10.3	1021.4	0
	700	6	73	11.0	1020.0	0
	1300	7	84	12.2	1017.0	0
	1900	9	83	12.0	1014.6	0
16	100	4	90	12.1	1010.5	0
	700	9	111	13.5	1006.8	0
	1300	11	117	14.4	1003.1	7
	1900	5	296	13.6	1001.1	0

TABLE 2: Meteorological Data

APR 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
17	100	3	173	13.2	1001.4	0
	700	3	135	11.8	1002.1	0
	1300	6	108	15.4	1003.8	0
	1900	8	103	13.0	1004.1	0
18	100	3	18	13.0	1004.8	0
	700	4	14	11.9	1006.5	0
	1300	5	358	14.3	1008.9	0
	1900	7	3	11.3	1010.2	0
19	100	7	33	11.8	1010.5	0
	700	9	4	10.5	1013.3	0
	1300	11	2	12.0	1013.9	0
	1900	11	2	10.9	1014.6	0
20	100	9	354	11.4	1013.3	0
	700	14	1	11.4	1013.9	0
	1300	12	359	11.3	1015.6	0
	1900	12	2	10.8	1015.6	0
21	100	8	351	10.8	1013.9	0
	700	13	355	10.9	1013.9	0
	1300	11	358	11.9	1012.2	0
	1900	9	4	12.5	1011.2	0
22	100	7	355	11.5	1010.5	0
	700	8	5	12.4	1012.6	0
	1300	8	9	13.8	1013.3	0
	1900	7	19	11.4	1014.9	0
23	100	9	9	11.2	1015.6	0
	700	9	15	10.8	1016.0	0
	1300	7	359	12.8	1014.6	0
	1900	6	19	10.9	1012.6	0
24	100	4	9	11.9	1011.2	0
	700	2	29	12.6	1010.5	0
	1300	2	84	16.2	1008.5	0
	1900	5	79	14.2	1007.2	0
25	100	2	342	14.1	1006.1	0
	700	10	9	10.4	1010.2	0
	1300	14	4	9.7	1012.2	0
	1900	17	7	8.5	1013.6	0
26	100	17	9	8.2	1013.3	0
	700	16	0	8.5	1013.6	16
	1300	18	357	8.5	1016.0	11
	1900	14	7	9.3	1017.7	0
27	100	11	11	9.5	1017.0	0
	700	12	11	9.4	1017.7	0
	1300	10	14	10.6	1018.0	0
	1900	7	29	9.0	1016.0	0
28	100	3	104	8.9	1012.9	0
	700	3	184	11.2	1010.9	0
	1300	9	7	13.2	1010.9	0
	1900	2	79	10.9	1011.6	0
29	100	3	280	9.9	1012.9	0
	700	2	244	12.2	1014.3	0
	1300	6	231	19.0	1010.2	0
	1900	9	213	17.0	1005.5	0
30	100	12	239	17.0	1003.8	0
	700	9	246	17.2	1005.1	0
	1300	5	61	15.7	1008.5	0
	1900	4	114	12.2	1010.9	0

III. WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645) and two Waverider buoys (Gages 630 and 640) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height (H_{mo}) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. The period (T_p) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed for all data records collected. Figure 3 is a time history of the H_{mo} and T_p values for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

Part 1

APR 1987

Day	Hour	645		625		640		630	
		Baylor Hmo(m)	at 7+80 T(sec)	Baylor Hmo(m)	at 19+00 T(sec)	Nearsh Hmo(m)	Wvrdr T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
1	01	1.42	12.80	1.75	11.64			1.88	12.80
	07	1.29	12.80	1.74	11.64			1.93	5.45
	13	1.03	12.80	1.28	12.20			1.35	12.20
	19	0.77	11.64	1.13	11.64			1.22	11.14
2	01	0.54	11.64	0.84	11.14			0.85	12.20
	07	0.45	11.14	0.80	11.64			0.76	10.66
	13	0.68	10.66	0.87	11.14			0.90	11.14
	19	0.63	3.71	0.74	10.66			0.83	10.66
3	01	0.37	10.66	0.55	10.24			0.68	11.14
	07	0.32	9.48	0.53	10.24			0.62	10.66
	13	0.71	4.92	0.83	4.83			0.95	4.74
	19	0.79	4.83	0.83	5.69			1.21	5.95
4	01	1.34	8.26	1.35	7.76			1.74	8.26
	07	1.83	8.53	1.69	9.14			2.18	8.53
	13	1.13	8.83	1.13	8.83			1.60	8.53
	19	0.70	9.48	0.79	9.14			1.05	8.26
5	01	0.53	10.24	0.71	9.48			0.95	9.14
	07	0.48	11.14	0.70	10.66			0.85	10.24
	13	0.52	10.66	0.88	10.66			0.90	10.66
	19	0.46	10.24	0.74	9.84			0.92	9.84
6	01	0.47	9.84	0.80	9.84	Gage Inoperative		0.83	9.84
	07	0.33	9.48	0.57	9.48			0.71	9.48
	13	0.28	9.84	0.51	8.83			0.73	8.83
	19	0.23	9.14	0.44	8.83			0.53	8.00
7	01	0.23	10.24	0.38	9.48			0.47	8.53
	07	0.23	6.09	0.38	9.48			0.47	9.14
	13	0.25	5.56	0.33	9.14			0.46	8.26
	19	0.20	5.56	0.30	8.26			0.40	7.53
8	01	0.29	4.57	0.32	13.48			0.44	14.22
	07	0.26	13.48	0.34	12.80			0.37	13.48
	13	0.30	12.80	0.39	12.80			0.41	12.80
	19	0.28	13.48	0.50	12.20			0.50	12.20
9	01	0.34	12.80	0.48	12.80			0.59	11.64
	07	0.38	12.80	0.47	11.64			0.53	12.20
	13	0.71	3.32	0.74	12.20			0.88	12.20
	19	0.44	4.13	0.53	12.20			0.57	11.64
10	01	0.34	11.64	0.47	12.20			0.57	11.64
	07	0.29	11.64	0.42	12.20			0.42	11.64
	13	0.21	11.64	0.38	11.14			0.43	11.14
	19	0.29	11.64	0.37	11.14			0.35	11.14
11	01	0.19	10.66	0.28	11.14			0.36	10.66
	07	0.24	11.14	0.27	11.14			0.30	11.14
	13	0.42	2.69	0.44	11.14			0.60	3.12
	19	0.31	3.46	0.37	10.66			0.55	3.51

* Electronic problems

TABLE 3: WAVE DATA

Part 2

APR 1987

Day	Hour	645		625		640		630	
		Baylor at 7+80 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshr Hmo(m)	Wvrdr T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
12	01	0.37	3.71	0.33	11.14			0.52	5.22
	07	0.50	6.09	0.52	6.92			0.74	5.95
	13	0.64	5.82	0.48	5.95			0.76	6.74
	19	0.50	6.92	0.58	6.92			0.90	6.92
13	01	0.41	5.95	0.39	6.57			0.62	6.74
	07	Software Error							
	13	0.44	8.26	0.40	8.26			0.55	7.32
	19	0.33	7.11	0.40	8.00			0.60	3.05
14	01	0.97	4.83	1.04	4.92			1.19	4.83
	07	1.16	6.24	1.45	6.40			1.76	8.53
	13	1.26	11.14	1.60	11.14			1.72	11.14
	19	1.19	11.64	1.60	10.66			1.71	10.66
15	01	1.65	12.20	1.72	11.64			1.64	10.66
	07	1.42	12.20	1.86	12.80			1.89	12.80
	13	1.54	12.80	1.75	12.20			1.93	12.20
	19	1.16	11.64	1.68	11.14			1.69	11.64
16	01	1.23	11.64	1.43	11.64			1.53	10.66
	07	1.24	5.69	1.56	6.24			1.88	5.95
	13	1.57	7.32	1.75	7.32			2.11	7.32
	19	1.68	8.26	1.82	8.83			2.56	8.53
17	01	1.23	9.14	1.54	9.14			2.07	9.14
	07	1.24	8.26	1.54	9.48	Gage Inoperative		1.77	8.26
	13	1.23	8.00	1.48	9.48			1.63	8.26
	19	1.06	8.26	1.38	8.83			1.59	8.26
18	01	0.90	8.00	1.18	10.24			1.49	10.24
	07	1.02	8.00	1.35	9.14			1.48	7.76
	13	0.89	9.48	1.21	9.84			1.37	8.83
	19	0.96	8.83	1.22	9.14			1.27	8.53
19	01	0.98	8.53	1.22	9.84			1.38	8.83
	07	1.06	4.66	1.30	9.14			1.38	8.26
	13	1.02	4.49	1.35	8.26			1.55	9.48
	19	1.24	5.69	1.55	9.14			1.77	5.95
20	01	1.02	5.45	1.42	9.48			1.51	9.48
	07	1.45	5.56	1.66	5.82			1.87	5.69
	13	1.40	6.40	1.79	6.40			2.00	6.24
	19	1.40	5.95	1.62	6.24			1.76	6.74
21	01	1.09	5.69	1.34	7.32			1.50	6.92
	07	1.34	5.12	1.63	6.57			2.05	5.95
	13	1.13	6.09	1.54	8.83			3.09	7.11
	19	1.03	5.69	1.36	9.48			1.52	9.14
22	01	0.81	9.14	1.32	8.83			1.47	8.83
	07	Software Error							
	13	0.70	8.83	1.07	8.83			1.09	8.83
	19	0.64	8.53	1.01	8.53			1.09	8.53

* Electronic problems

TABLE 3: WAVE DATA

Part 3

APR 1987

Day	Hour	645		625		640		630	
		Baylor at 7+80 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshr Hmo(m)	Wvrdr T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
23	01	0.74	4.34	1.21	8.00			1.40	8.00
	07	0.93	5.82	1.23	8.00			1.56	5.82
	13	0.98	7.11	1.24	7.11			1.45	8.00
	19	0.82	8.00	1.07	7.11			1.29	8.00
24	01	0.73	7.32	0.96	7.76			1.09	7.76
	07	0.68	6.92	0.84	8.26			0.98	7.76
	13	0.65	5.45	0.88	7.53			1.03	7.53
	19	0.63	4.83	0.88	8.26			0.88	7.53
25	01	0.61	4.74	0.77	7.53			0.87	8.00
	07	1.35	6.09	1.36	6.24			2.00	5.95
	13	1.96	7.53	2.08	8.00			2.75	7.11
	19	2.32	9.14	3.01	9.84			3.69	7.32
26	01	1.99	11.14	3.05	10.66			3.81	8.83
	07	2.21	10.24	2.97	11.14			3.42	11.14
	13	1.98	10.24	2.92	10.66	Gage Inoperative		3.48	10.66
	19	2.23	9.48	3.14	11.14			3.43	10.66
27	01	1.90	11.14	2.73	11.14			2.65	10.66
	07	2.01	11.14	2.60	11.14			2.64	9.84
	13	1.75	10.66	2.37	10.66			2.50	11.14
	19	1.70	11.14	2.17	9.48			3.04	8.00
28	01	1.73	11.64	1.91	11.14			1.83	9.84
	07	1.35	13.48	1.74	12.80			1.75	10.24
	13	1.97	13.48	2.04	13.48			1.85	13.48
	19	1.83	13.48	2.05	13.48			2.00	12.80
29	01	1.88	13.48	1.81	13.48			1.85	13.48
	07	1.00	12.20	1.43	12.20			1.46	12.20
	13	0.93	12.80	1.09	12.20			2.80	11.64
	19	0.62	12.80	0.88	12.20			1.32	12.20
30	01	0.53	13.48	0.61	12.80			0.88	12.80
	07	0.46	12.80	0.57	12.80			0.74	12.80
	13	0.59	12.80	0.64	12.80			0.63	12.20
	19	0.49	12.80	0.69	12.80			0.64	12.80
Mean		0.93	8.92	1.17	9.84			1.39	9.27
Std dev		0.55	3.00	0.68	2.12			0.84	2.44

* Electronic problems

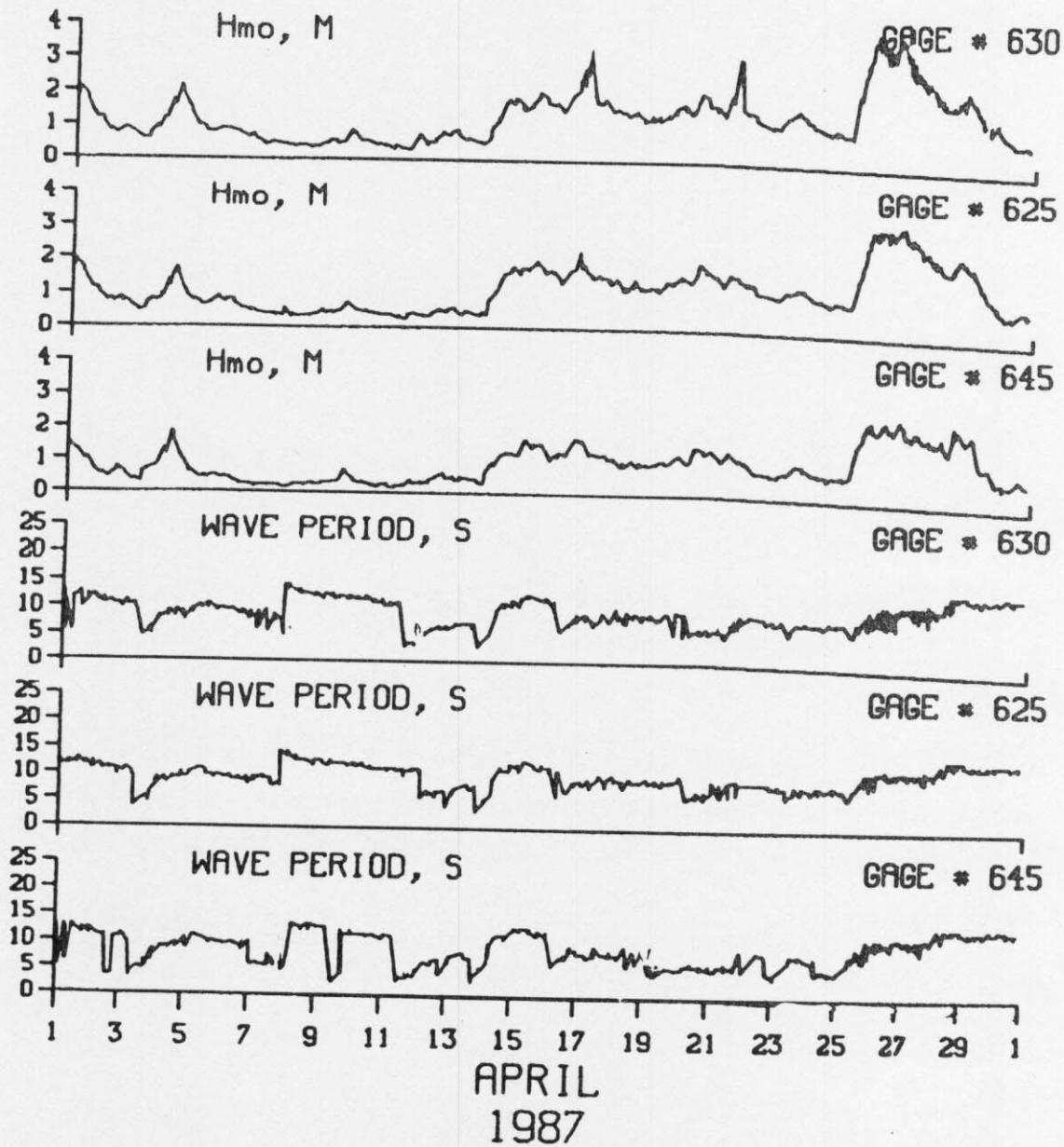


FIGURE 3. Time History of Wave Heights and Periods

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: Current Data
APR 1987

Day	Time	Pier Measurements				Beach Measurements				Current Meter	
		Dye at (579 m) Speed	Dye at (surface) Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
1	0100-Along Cross Result									19	S on
										3	
										19	169
1	0700-Along Cross Result	122 12 123	S off 154	226	76 8 77	S off 154	no observation			29	S on
										5	
										29	170
1	1300-Along Cross Result									23	S on
										3	
										23	167
1	1900-Along Cross Result									1	S on
										6	
										6	241
2	0100-Along Cross Result									6	S off
										4	
										7	126
2	0700-Along Cross Result	17 11 21	N off 13	213	22 11 24	N off 7	South	13	N	7	N off
										1	
										7	348
2	1300-Along Cross Result									14	N on
										4	
										15	324
2	1900-Along Cross Result									32	N off
										4	
										32	347
3	0100-Along Cross Result									18	N off
										2	
										18	346
3	0700-Along Cross Result	0 0 0		140	0 0 0		North	28	S	8	N on
										1	
										8	333
3	1300-Along Cross Result									11	S on
										7	
										13	192
3	1900-Along Cross Result									14	S on
										4	
										15	176
4	0100-Along Cross Result									4	S on
										2	
										4	187
4	0700-Along Cross Result	36 25 44	N off 15	274	30 53 61	N off 40	South	64	N	9 4 10	N off 4
4	1300-Along Cross Result									25	N off
										4	
										25	349
4	1900-Along Cross Result									26	N off
										5	
										26	351
5	0100-Along Cross Result									17	N off
										3	
										17	350
5	0700-Along Cross Result	no observ		201	14 16 21	N off 29	North	22	S	13 2 13	N off 2
5	1300-Along Cross Result									5 2 5	N off 2
5	1900-Along Cross Result									7 1 7	N off 348

KEY = All speeds in CM/SEC

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

TABLE 4: Current Data
APR 1987

Day	Time	Pier Measurements				Beach Measurements				Current Meter	
		Alongshore Cross-shore Resultant Speed	Dye at (579 m) (surface)	Distance from Baseline (m)	Mid-Surf Zone (surface)	Dye 12m offshore (surface)	Location	Speed	Dir	at South Tripod Depth -4.8m (NGVD) ID #679	Speed
6	0100-Along Cross Result									15	N
6	0700-Along Cross Result	0 5 5	off 70	189	0 18 18	off 70	North	5	S	2 1 12	N off 345
6	1300-Along Cross Result									1 4 4	S off 84
6	1900-Along Cross Result									13 2 13	S on 169
7	0100-Along Cross Result									6 1 6	S on 169
7	0700-Along Cross Result	47 2 47	S off 157	140	23 0 23	S 160	North	1	S	20 10 22	S on 187
7	1300-Along Cross Result									13 2 13	S on 169
7	1900-Along Cross Result									7 4 8	S on 190
8	0100-Along Cross Result									6 10 12	S on 219
8	0700-Along Cross Result	41 0 41	S 160	140	18 1 18	S off 157	North	12	S	4 0 4	S 160
8	1300-Along Cross Result									17 0 17	S 160
8	1900-Along Cross Result									16 3 16	S on 171
9	0100-Along Cross Result									2 0 2	N 340
9	0700-Along Cross Result	30 15 34	S on 187	189	17 3 18	S on 169	North	14	S	7 5 9	S on 196
9	1300-Along Cross Result									31 6 32	S on 171
9	1900-Along Cross Result									27 4 27	S on 168
10	0100-Along Cross Result									18 3 18	S on 169
10	0700-Along Cross Result	12 16 20	S off 107	140	17 12 21	S off 125	North	4	S	12 0 12	S 160
10	1300-Along Cross Result									10 3 10	S off 143
10	1900-Along Cross Result									13 1 13	S off 156

KEY = All speeds in CM/SEC
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S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
APR 1987

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter at South Tripod				
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir	Depth -4.8m (NGVD) ID #679
11 0100	Along Cross Result											2	N	
												4	on	277
												4		
11 0700	Along Cross Result	41 2 41	N off 343		165	17 10 20	N off 11		South	21	N	7 5 9	N on 304	
11 1300	Along Cross Result											9 2 9	N off 353	
												1 0 1	N 340	
11 1900	Along Cross Result											0 0 0		
12 0100	Along Cross Result	20 2 20	N off 346		189	24 2 25	N off 346		South	27	N	6 2 6	S on 178	
12 0700	Along Cross Result	21 1 21	S on 163		140	0 6 6	off 70		North	9	S	2 2 3	S on 205	
12 1300	Along Cross Result											8 2 8	N off 354	
12 1900	Along Cross Result											1 3 3	N off 52	
13 0100	Along Cross Result											8 7 11	S on 201	
13 0700	Along Cross Result	21 1 21	S on 163		140	0 6 6	off 70		North	9	S	9 0 9	S 160	
13 1300	Along Cross Result											21 5 22	S on 173	
13 1900	Along Cross Result											37 14 40	S on 181	
14 0100	Along Cross Result	55 0 55	S 160		213	28 25 37	S on 202		North	66	S	32 7 33	S on 172	
14 0700	Along Cross Result											20 3 20	S on 169	
14 1300	Along Cross Result											14 3 14	S on 172	
14 1900	Along Cross Result											9 0 9	S on 160	
15 0100	Along Cross Result											15 6 16	N on 318	
15 0700	Along Cross Result	0 40 40	on 250		213	29 17 34	N on 309		no observation			10 2 10	S on 171	
15 1300	Along Cross Result													
15 1900	Along Cross Result													

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N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

TABLE 4: Current Data
APR 1987

Day	Time	Pier Measurements				Beach Measurements				Current Meter	
		Dye at (579 m) Speed	Dye at (surface) Dir	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	at South Tripod
16	0100-Along Cross Result								16	S	Depth -4.8m (NGVD)
16	0700-Along Cross Result	28 11 30	N on 318	262	44 4 44	N on 334	no observation		11 1 11	S off 155	ID #679
16	1300-Along Cross Result								24 5 25	N on 328	
16	1900-Along Cross Result								12 5 13	N off 3	
17	0100-Along Cross Result								19 1 19	S on 163	
17	0700-Along Cross Result	6 0 6	S on 160	165	55 50 75	N on 298	South	46	N	6 4 7	N on 306
17	1300-Along Cross Result								6 9 11	S on 216	
17	1900-Along Cross Result								5 1 5	N off 351	
18	0100-Along Cross Result								1 5 5	N on 261	
18	0700-Along Cross Result	61 3 61	S on 163	201	1 0 1	S off 138	no observation		21 6 22	S on 176	
18	1300-Along Cross Result								32 17 36	S on 188	
18	1900-Along Cross Result								16 11 19	S on 195	
19	0100-Along Cross Result								22 9 24	S on 182	
19	0700-Along Cross Result				no observations were made				27 9 28	S on 178	
19	1300-Along Cross Result								32 6 33	S on 171	
19	1900-Along Cross Result								36 10 37	S on 176	
20	0100-Along Cross Result								32 6 33	S on 171	
20	0700-Along Cross Result	102 0 102	S on 160	226	68 68 96	S off 115	no observation		51 6 51	S on 167	
20	1300-Along Cross Result								62 5 62	S on 165	
20	1900-Along Cross Result								46 3 46	S on 164	

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on = onshore off = offshore

TABLE 4: Current Data
APR 1987

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements			Current Meter		
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
21 0100-Along Cross Result											37	S on
											4	
											37	166
21 0700-Along Cross Result	68 0	S 160		238	51 0	S 160			no observation		46	S on
	68				51						3	
											46	164
21 1300-Along Cross Result											46	S on
											2	
											46	162
21 1900-Along Cross Result											26	S off
											3	
											26	153
22 0100-Along Cross Result											23	S
											0	
											23	160
22 0700-Along Cross Result	44 2	S off		165	44 0	S 160		North	23	S		
	44	157			44							
22 1300-Along Cross Result											23	S on
											4	
											23	170
22 1900-Along Cross Result											25	S on
											7	
											26	176
23 0100-Along Cross Result											27	S on
											3	
											27	166
23 0700-Along Cross Result	87 4	S off		165	55 17	S off		North	17	S	44	S
	87	157			58						7	on
23 1300-Along Cross Result											45	169
23 1900-Along Cross Result											43	S off
											1	
											43	159
24 0100-Along Cross Result											41	S
											7	on
											42	170
24 0700-Along Cross Result	47 14	S on		152	51 8	S on		North	35	N	17	S on
	49	177			51						4	
24 1300-Along Cross Result											17	173
24 1900-Along Cross Result											1	S on
											1	
											1	205
25 0100-Along Cross Result											6	S off
											1	
											6	151
25 0700-Along Cross Result	76 0	S 160		274	102 0	S 160		no observation			44	S on
	76				102						4	
25 1300-Along Cross Result											44	165
25 1900-Along Cross Result											65	S
											5	on
											65	164

KEY = All speeds in CM/SEC

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S = Southward, Shore parallel

on = onshore off = offshore

TABLE 4: Current Data
APR 1987

Day	Time	Pier Measurements				Beach Measurements				Current Meter			
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
26	0100-Along Cross Result											114	S
												14	on
												115	167
26	0700-Along Cross Result	61 0	S		274	76 23 80	S off 143		North	119	S	94 15 95	S on 169
		61 160											
26	1300-Along Cross Result											102 14 103	S on 168
26	1900-Along Cross Result											87 17 89	S on 171
27	0100-Along Cross Result											56 10 57	S on 170
27	0700-Along Cross Result	102 0	S		244	1 0 3	S off 81		no observation			45 5 45	S on 166
		102 160											
27	1300-Along Cross Result											45 6 45	S on 168
27	1900-Along Cross Result											41 4 41	S on 166
28	0100-Along Cross Result											13 4 14	S on 177
28	0700-Along Cross Result	32 0	S		213	34 10 35	N off 357		North	37	N	14 2 14	N on 332
		32 160											
28	1300-Along Cross Result											23 3 23	S on 167
28	1900-Along Cross Result											24 4 24	S on 169
29	0100-Along Cross Result											31 5 31	S on 169
29	0700-Along Cross Result	17 3	S off		189	25 6 26	N off 354		South	17	S	25 4 25	S on 169
		18 151											
29	1300-Along Cross Result											17 2 17	S off 153
29	1900-Along Cross Result											7 6 9	N off 21
30	0100-Along Cross Result											20 10 22	N off 7
30	0700-Along Cross Result	5 2	N off		165	14 1 14	N on 334		South	19	N	20 7 21	N off 359
		5 357											
30	1300-Along Cross Result											4 2 4	N off 7
30	1900-Along Cross Result											5 2 5	N off 2

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V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5
SUPPLEMENTAL OBSERVATIONS

APR 1987

DAY	TIME	WAVE APPROACH ANGLE AT PIER END			RADAR WAVE ANGLE deg from True N	WIDTH OF SURF ZONE(m)	WATER CHARACTERISTICS AT PIER END		
		Primary	Secondary				DENSITY (g/cc)	SECCI VIS(m)	
1	740	40	100			308	5.4		0.6
2	710	100	100			1	6.0		1.8
3	800	20			20	38	6.6		1.5
4	917	30			95	47	7.1		0.9
5	1130	35	40			98	7.0		1.5
6	830	30				5	6.8		1.5
7	808	60				79	7.4		1.5
8	820	80				67	9.5	1.0204	2.4
9	800	30				3	10.1		2.1
10	810	70				55	10.5	1.0208	2.1
11	1022	no observation				9	12.2		3.0
12	1245	30			30	3	8.5		4.0
13	925	105				85	7.5		3.0
14	925	50			65	341	11.6		1.8
15	840	90			100	322	12.0	1.0200	1.5
16	944	70	130		70	271	11.3		1.5
17	839	70	115			259	10.6		1.5
18	910	90				0	11.8		3.0
19	no observations made								
20	735	15	80		50	326	12.0	1.0196	1.2
21	720	70	20		75	497	12.1	1.0190	0.6
22	724	70	10		80	104	12.5	1.0197	0.6
23	830	60	10		70	143	13.2	1.0189	0.6
24	837	80				113	13.9	1.0172	0.9
25	1200	35			40	475	13.8	1.0175	0.9
26	900	60			60	475			0.3
26	1215	70	40		65	628			
28	915	75			75	372	11.1	1.0207	0.6
29	848	80				268	12.7	1.0188	0.9
30	927	no observation				0	12.5		2.4

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF TIDE HEIGHTS
APR 1987

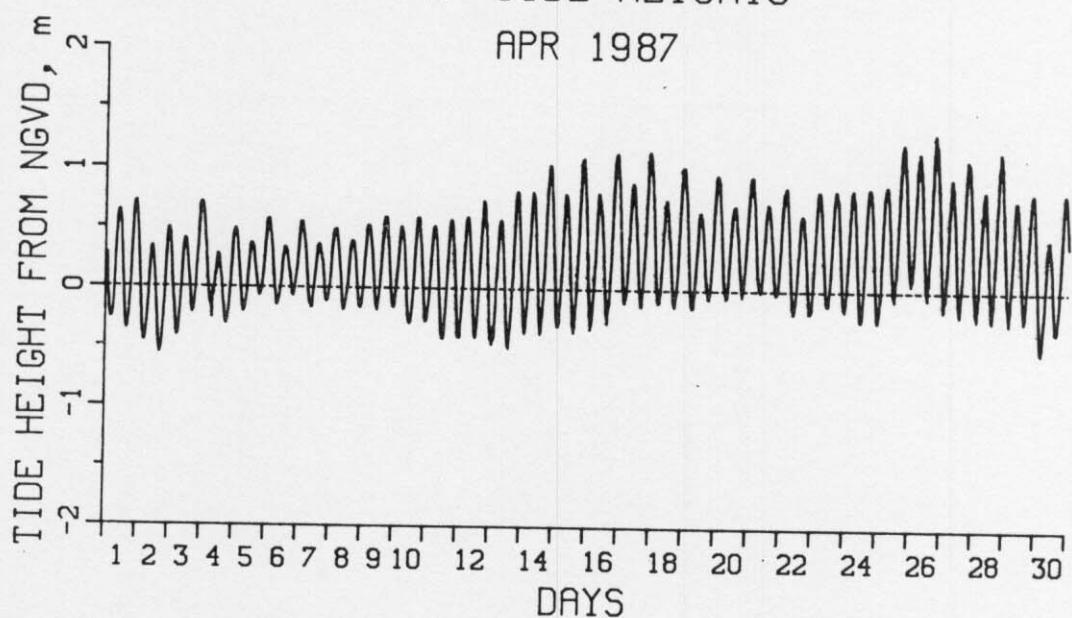


FIGURE 4. Time History of Mean Water Levels, April 1987

MONTHLY WATER LEVELS (METERS MSL)

Extreme Low -	-0.56 on 2 April at 1536 hrs.
Extreme High -	1.31 on 26 April at 1806 hrs.
Monthly Mean -	0.26
Mean Low -	-0.23
Mean High -	0.74
Mean Range -	0.97

Table 6: WATER LEVELS (METERS NGVD)

MID-CYCLE DAY TIME		LOW	HIGH	MEAN	RANGE
1	612	-0.26	0.64	0.17	0.90
1	1837	-0.35	0.72	0.18	1.07
2	703	-0.45	0.34	-0.06	0.80
2	1928	-0.56	0.49	-0.03	1.05
3	753	-0.41	0.41	0.02	0.81
3	2018	-0.22	0.71	0.26	0.93
4	843	-0.26	0.28	0.05	0.54
4	2109	-0.31	0.49	0.11	0.80
5	934	-0.21	0.37	0.09	0.58
5	2159	-0.07	0.57	0.24	0.64
6	1024	-0.15	0.34	0.11	0.48
6	2249	-0.07	0.55	0.24	0.62
7	1115	-0.17	0.36	0.11	0.53
7	2340	-0.12	0.49	0.19	0.61
8	1205	-0.19	0.39	0.12	0.58
9	30	-0.17	0.52	0.18	0.69
9	1255	-0.18	0.59	0.21	0.77
10	121	-0.16	0.51	0.18	0.67
10	1346	-0.30	0.59	0.13	0.88
11	211	-0.28	0.52	0.13	0.80
11	1436	-0.43	0.57	0.07	1.00
12	301	-0.41	0.59	0.10	1.01
12	1527	-0.41	0.73	0.14	1.15
13	352	-0.47	0.57	0.05	1.04
13	1617	-0.50	0.81	0.16	1.31
14	442	-0.37	0.81	0.22	1.18
14	1707	-0.38	1.03	0.35	1.41
15	532	-0.31	0.79	0.24	1.11
15	1758	-0.36	1.09	0.39	1.45
16	623	-0.34	0.80	0.26	1.14
16	1848	-0.29	1.13	0.46	1.42
17	713	-0.11	0.89	0.37	1.00
17	1938	-0.14	1.15	0.52	1.29
18	804	-0.11	0.75	0.32	0.86
18	2029	-0.14	1.02	0.45	1.16
19	854	-0.15	0.65	0.26	0.80
19	2119	-0.07	0.96	0.45	1.03
20	944	-0.07	0.71	0.34	0.77
20	2210	-0.05	0.95	0.47	1.00
21	1035	-0.01	0.73	0.36	0.74
21	2300	-0.03	0.86	0.40	0.90
22	1125	-0.19	0.63	0.24	0.82
22	2350	-0.19	0.83	0.31	1.02
23	1216	-0.12	0.84	0.35	0.96
24	41	-0.17	0.84	0.34	1.01
24	1306	-0.25	0.86	0.32	1.11
25	131	-0.26	0.88	0.32	1.13
25	1356	-0.08	1.23	0.57	1.31
26	222	0.06	1.16	0.60	1.10
26	1447	-0.06	1.31	0.62	1.37
27	312	-0.16	0.94	0.42	1.11
27	1537	-0.20	1.09	0.46	1.30
28	402	-0.23	0.84	0.32	1.08
28	1628	-0.25	1.16	0.43	1.41
29	453	-0.27	0.76	0.29	1.03
29	1718	-0.25	0.82	0.29	1.07
30	543	-0.52	0.44	-0.03	0.96
30	1808	-0.34	0.82	0.22	1.16

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in March and the two surveys taken during April on profile line 188, located 517 m south of the pier. Accretion is visible along the entire length of the profile. The foreshore (70 to 110 m) accreted 0.3 m and the nearshore trough (120 to 240 m) approached 1 m with 1.25 m accretion on the crest. Significant deposition is also visible offshore extending from the storm bar (400 m) to the seaward end of the profile.

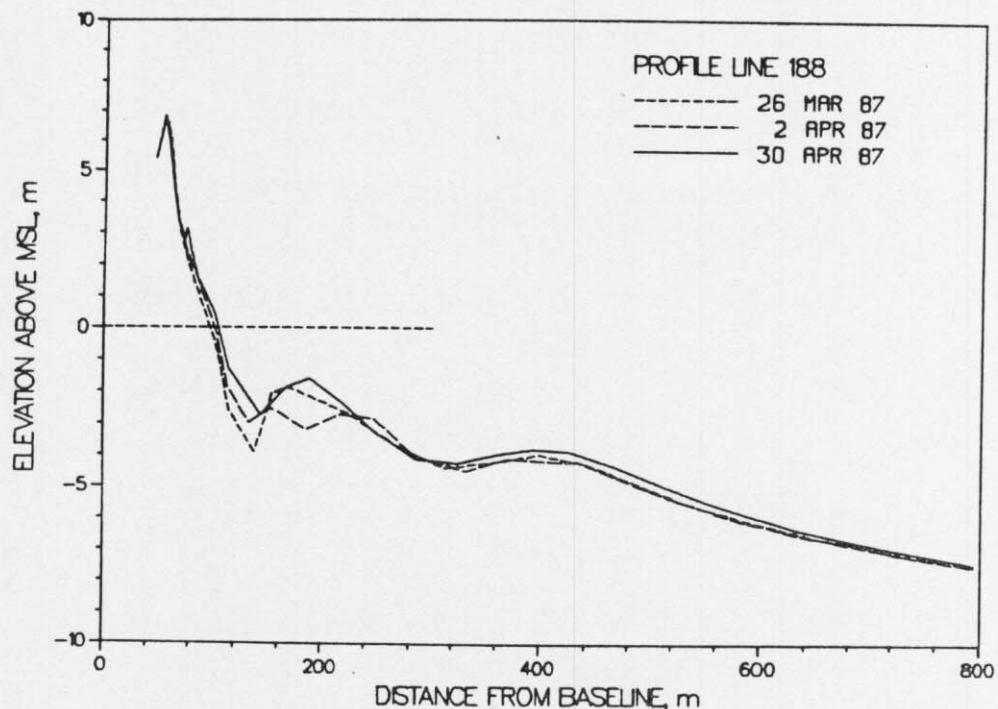


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile since the end of 1986. The most significant change is the accretion visible on the offshore portion of the profile (400 to 790 m). The change visible in the nearshore (200 m) represents the flattening out of the nearshore bar early in the month.

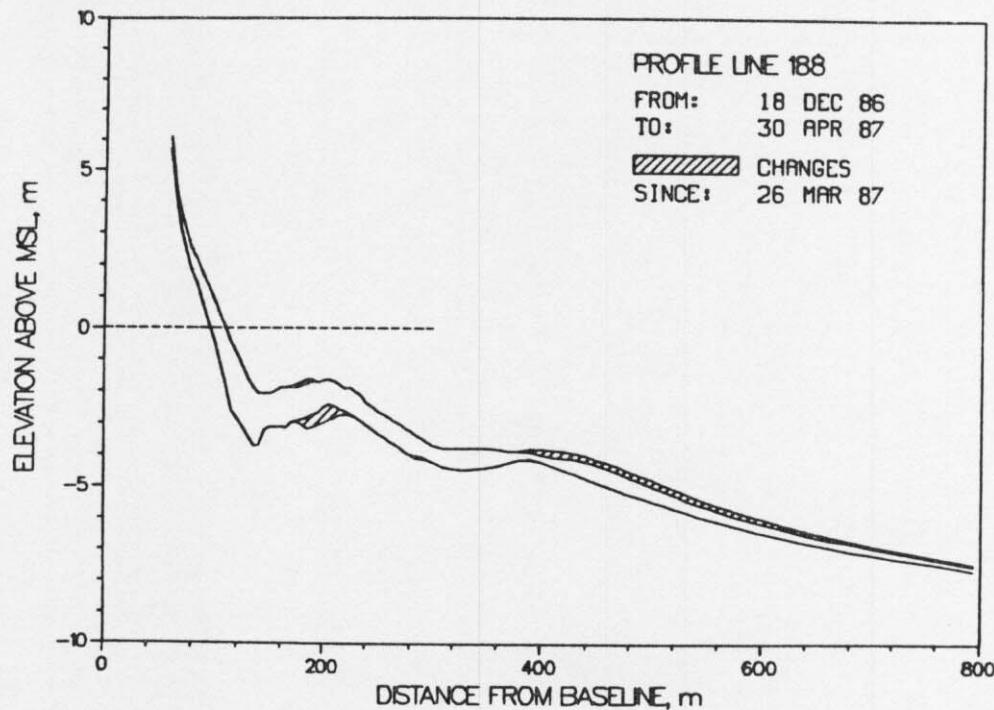


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 is a contour map showing the bathymetry around the pier on 2 April.

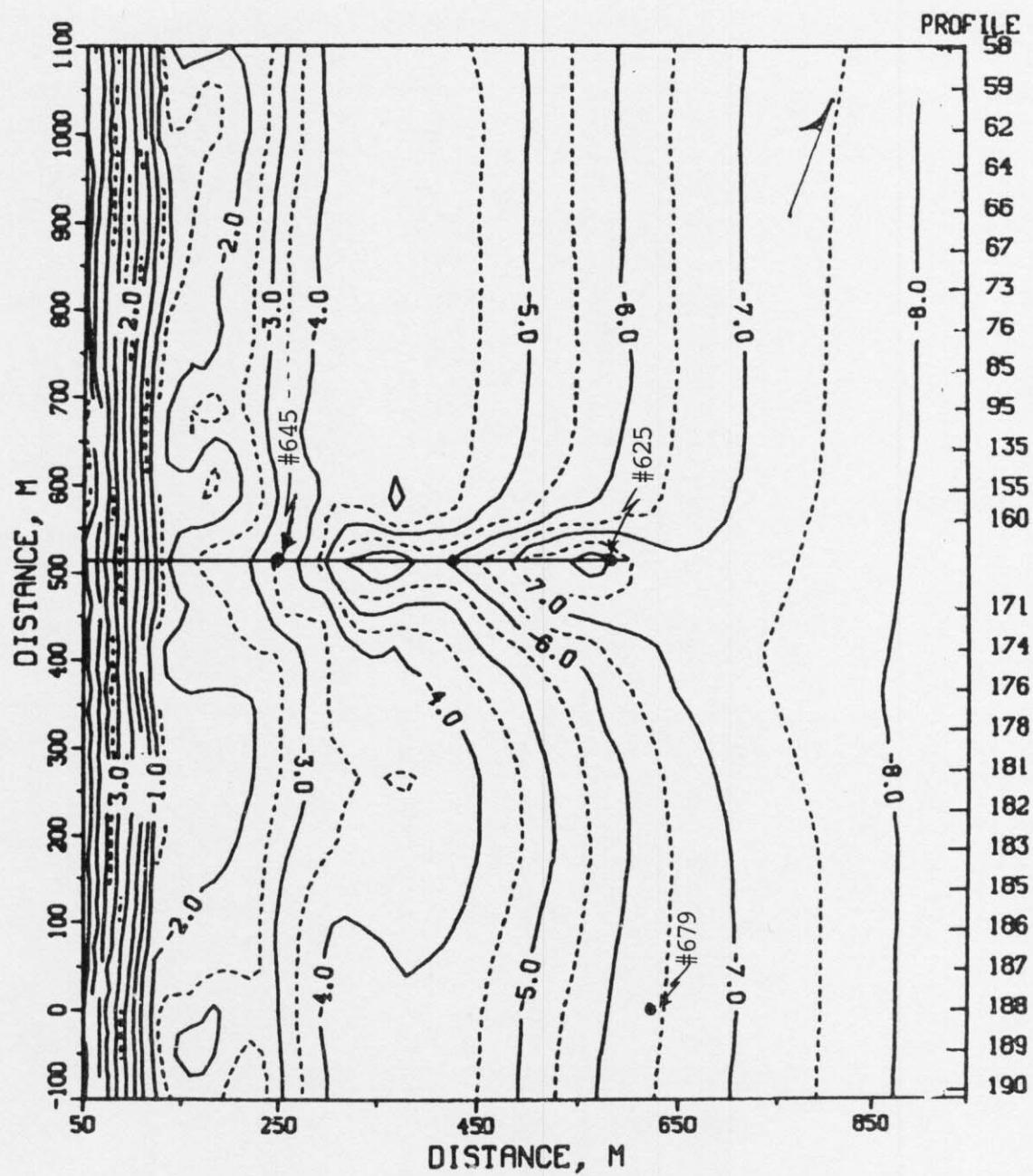


Figure 7. FRF BATHYMETRY 2 APR 87
CONTOURS IN METERS

VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height at the seaward end of the pier (i.e. as measured by the Baylor Gage #625 at pier station 19+00) exceeded 2 m. When this occurred, four contiguous 34-min wave records were obtained every hour:

<u>Start</u>	<u>End</u>
16 April (1142)	16 April (1634)
25 April (1142)	28 April (0428)

B. Storm Synopsis.

16 April - This storm originated over the central US and was located over western South Carolina by 16 April. It rapidly weakened and moved offshore on 18 April. On the 16th, maximum wind speeds exceeded 12 m/s (ESE) peaking at 1108 hrs; the maximum Hmo (at Gage #625) of 2.25 m (period = 7.53) was recorded at 1600 hrs; and the lowest barometric pressure of 1000 mb occurred at 1416 hrs. Total precipitation was 7mm.

25-28 April - This storm developed over Georgia on 23 April, slowly traveled to the northeast, and became almost stationary off Cape Hatteras, NC. By 25 April, the low developed into a major storm and moved well offshore on 27 April. On the 26th, maximum onshore winds (N to NNE) exceeded 18 m/s at 1442 hrs; the maximum Hmo of 3.14 m (period = 11.14 sec) occurred 5 hrs later; and the lowest barometric pressure of 1012 mb was recorded at 1408 hrs. Total precipitation was 27 mm.

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